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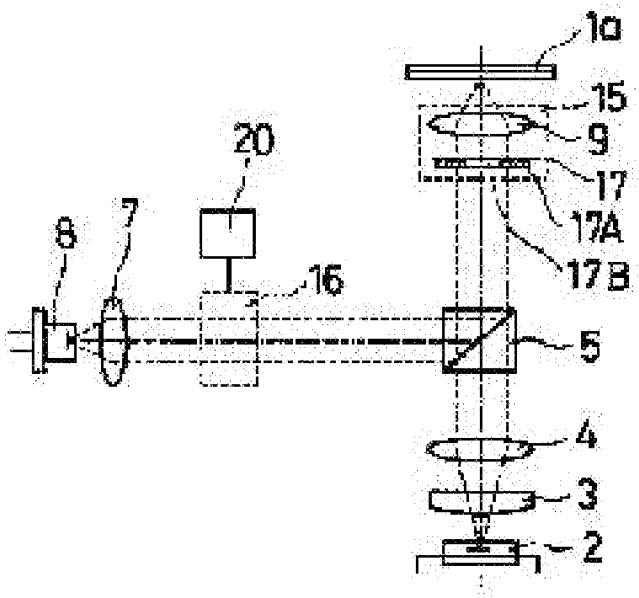
(54) **PICKUP DEVICE**

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a pickup device which is further light in weight and low in the cost and capable of using different types of optical disks.
SOLUTION: The device is provided with a polarization rotating device capable of rotating the plane of polarization of the light outgoing from a light source 8, a driving means 20 of the polarization rotating device 16 and a polarizing plate 17 through which the light beam having passed the polarization rotating device 16 is transmitted. Thereby, it is determined whether the device 16 is to be driven or not depending on the types of optical disks, and the rotational angle of the plane of polarization of light can be varied. Furthermore since the light having transmitted the device 16 obtains an aperture limiting effect, the condensing position of the object lens is made different and light is optimally condensed on the recording layers of the optical disk different in type.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the pickup used for an optical disk drive.
[0002]
[Description of the Prior Art]The recorded information on an optical disc is recorded by irradiating the recording layer of an optical disc with a laser beam, and opening a pit, irradiates an optical disc with a laser beam further, detects the existence of said pit and is played by the strength of the reflection. Such record and reproduction operation of the optical disc are performed by the pickup.

[0003]The wavelength of the optical beam which irradiates with the optical disc in which the kinds of optical disc differ according to the wavelength of the laser beam in which a pit is made to form at this time, and kinds differ at the time of playback also differs, respectively. For example, CD which uses the exposure laser of 780 nm bands now (below Compact Disc:.) a standard optical disk -- saying -- there is a DVD (below Digital Video Disc: calls it a high density optical disk) in which large scale and its thickness were slimmed down as compared with the standard optical disk, and the high density optical disk is using the exposure laser of the wavelength 635 - 650 nm bands. Although a standard optical disk irradiates with the optical beam of 780 nm bands and it is played, here, This is refreshable, even if it is as difficult as short wavelength, and manufacture of a laser light source originates in becoming a high cost, uses it for cost reduction and irradiates a standard optical disk with the optical beam of short wavelength from 780 nm.
[0004]Performing playback is proposed by the pickup of 1 from the former in playback of the above-mentioned standard optical disk and the high density optical disk, the typical outline composition of such a pickup is shown in drawing 12 thru/or drawing 15, and it explains below based on this drawing.
[0005]When playing the high density optical disk 1a (thickness: 0.6 mm) of composition of that drawing 12 pasted two boards together, drawing 13 is a schematic diagram of the pickup in the case of playing the standard optical disk 1b (thickness: 1.2 mm) which comprises one board. Hereafter, the composition of a pickup is explained based on drawing 12. A prescribed interval is set in the high density optical disk 1a and the position which counters, and the electric eye 2 is arranged. Between the high density optical disk 1a and the electric eye 2, The cylindrical lens 3, the condenser 4, the beam splitter 5, and the actuator moving part 6 are arranged one by one from the electric-eye 2 side, The collie mate lens 7 and the laser light source 8 are arranged at the position which intersects perpendicularly with the axis which connects the electric eye 2 to the high density optical disk 1a, and counters the beam splitter 5.
[0006]The beam splitter 5 equips the inside with the half mirror.
The optical beam which advanced into the beam splitter 5 is dichotomized to the transmitted light and catoptric light.
The movable movable aperture restriction board 11 is arranged by the object lens 9 and the drive mechanism 10 at the actuator moving part 6. At this time, the numerical aperture on which an optical beam is converged is set up the condensing position of the optical beam which the numerical aperture of the object lens 9 penetrates the object lens 9, and advances to the high density optical disk 1a come on the recording layer of the high density optical disk 1a. (In this specification, it is hereafter referred to as

"Condensing the optimal" that the converging position of the optical beam which penetrates an optical lens system turns into a desired position.)

[0007]The pickup of such composition explains a playback operation for the high density optical disk 1a. The optical beam emitted from the laser light source 8 advances into the collimate lens 7, is changed into a parallel pencil of rays, and advances to the beam splitter 5. With the half mirror of beam splitter 5 inside, the optical beam reflected among the optical beams which dichotomize to the transmitted light and catoptric light advances above drawing 12, and advances to the object lens 9 in the actuator moving part 6. The numerical aperture of the object lens 9 is set up as mentioned above condense the best for the recording layer of the high density optical disk 1a.

[0008]The object lens 9 is penetrated, and it goes on to the beam splitter 5, and dichotomizes to the transmitted light and catoptric light again, and the optical beam which penetrates the beam splitter 5 advances into the condenser 4, and the beam of light reflected by this recording layer converges so that it may condense to the electric eye 2. At this time, by penetrating the cylindrical lens 3 arranged between the condenser 4 and the electric eye 2, the optical beam can give the astigmatic difference so that it may condense the best for the electric eye 2. The electric eye 2 plays the high density optical disk 1a by detecting recorded information by the strength of an optical beam.

[0009]By the way, as mentioned above, since the object lens 9 has set up the numerical aperture corresponding to the high density optical disk 1a, when playing the standard optical disk 1b shown in drawing 13. Since a spherical aberration arises according to a difference of the thickness, since the optical beam after penetrating the object lens 9 cannot make it condense the best for the recording layer of the standard optical disk 1b, an error will produce it.

[0010]For this reason, the movable movable aperture restriction board 11 is formed in the above-mentioned actuator moving part 6 by driving the drive mechanism 10.

The movable aperture restriction board 11 is provided with the opening 12 of the numerical aperture which makes an optical beam condense the best for the recording layer of the standard optical disk 1b. Therefore, in playing the standard optical disk 1b, as shown in drawing 10, when the drive mechanism 10 is driven, the movable aperture restriction board 11 is moved and an optical beam penetrates the movable aperture restriction board 11, condensing becomes possible the best for the recording layer of the standard optical disk 1b. About other operations which play the standard optical disk 1b, it is the same as that of it of the high density optical disk 1a.

[0011]As an example of other pickups, as shown in drawing 14 (a) - (b), the above-mentioned actuator moving part 6 has some which were considered as the object lens 9 of a numerical aperture corresponding to the high density optical disk 1a, and the composition which carries object lens 9' of the numerical aperture corresponding to the standard optical disk 1b. According to the kind of optical discs 1a and 1b which it is going to play, the two above-mentioned kinds of optical discs 1a and 1b are played by changing the object lens 9 or object lens 9'.

[0012]As shown in drawing 15, the pickup which shall consist the composition of the above-mentioned actuator moving part 6 of the object lens 9, the liquid crystal shutter 13, and the control circuit 14 is also proposed. The liquid crystal shutter 13 is provided with the shade part 13A (shadow area).

By the control circuit 14, an optical beam can be changed so that protection from light and a penetration are possible.

Portions other than shade part 13A of the liquid crystal shutter 13 are the transparent parts 13B which can penetrate all of the corresponding wavelengths of the high density optical disk 1a and the standard

optical disk 1b.
[0013]In playing the high density optical disk 1a, when the control circuit 14 is turned OFF, an optical beam carries out to the ability of not only the transparent part 13B but the shade part 13A to be penetrated and the optical beam which penetrated the liquid crystal shutter 13 penetrates the object lens 9, it condenses the best for the recording layer of the high density optical disk 1a. On the other hand, in playing the standard optical disk 1b, the control circuit 14 is turned ON, in the shade part 13A, it is shaded and an optical beam penetrates only the transparent part 13B. Thus, by the liquid crystal shutter 13, the optical beam by which the part was intercepted penetrates the object lens 9, and condenses the best for the recording layer of the standard optical disk 1b. Therefore, it becomes refreshable about two kinds of optical discs 1a and 1b.
[0014]
[Problem(s) to be Solved by the Invention]By the way, since the high density optical disk 1a and the standard optical disk 1b in which using wavelengths differ as mentioned above differ in the thickness, they differ in the condensing position of each recording layer of both the optical discs 1a and 1b. For this reason, the movable aperture restriction board 11 is formed in the pickup shown in drawing 12 and drawing 13 at the actuator moving part 6. Therefore, in playing the high density optical disk 1a. In an optical beam's not penetrating the movable aperture restriction board 11, but penetrating only the object lens 9, condensing the best for the recording layer of the high density optical disk 1a and, playing the standard optical disk 1b on the other hand, The movable aperture restriction board 11 is moved, and when an optical beam penetrates the aperture restriction board 11 and the object lens 9, it condenses the best for the recording layer of the standard optical disk 1b.
[0015]Thus, since the movable aperture restriction board 11 must be moved according to the high density optical disk 1a and the standard optical disk 1b, it is necessary to form the drive mechanism 10 for moving the movable aperture restriction board 11. For this reason, the weight of the actuator moving part 6 had become increase and a factor of the characteristics degradation of an actuator.
[0016]In composition of having carried in the actuator moving part 6, object lens 9' the object lens 9 of **, and for the high density optical disk 1a standard optical disks 1b like the pickup shown in drawing 14, According to the high density optical disk 1a and the standard optical disk 1b, since the object lens 9 and object lens 9' need to be changed, a switching mechanism (graphic display abbreviation) must be provided in the actuator moving part 6. For this reason, since it had to have in a switching mechanism and the two object lenses 9 and 9, weight had become increase and a factor of the characteristics degradation of the actuator moving part 6 at the actuator moving part 6. When the position of the object lenses 9 and 9 shifts in order to make it move to an optical path in the matched-pairs thing lenses 9 and 9 in playing any of the optical discs 1a and 1b they are, since focusing distances differ, a gap of an optic axis is produced, and there is a problem of being easy to generate an error.
[0017]Like the pickup shown in drawing 15, when the liquid crystal shutter 13 is formed in the actuator moving part 6, in order not to move the liquid crystal shutter 13 and the object lens 9, become difficult to produce a gap of an optic axis, but. in order not to become according to the optical discs 1a and 1b to play if there is no change of ON-OFF of the control circuit 14, but to have such a mechanism, the weight of the actuator moving part 6 had become increase and a factor of the characteristics degradation of the actuator moving part 6. Since manufacture is difficult and a price becomes big-ticket under the present circumstances, the liquid crystal shutter 13 also produces the problem of leading to big-ticket-ization of

a pickup.
[0018]Therefore, this invention is refreshable in the optical disc 1a and the optical disc 1b in which it was made in light of the above-mentioned circumstances, and the characteristic is improved by carrying out the weight saving of the actuator moving part 6, and using wavelengths differ, and an object of this invention is to provide a cheap pickup.
[0019]
[Means for Solving the Problem]This invention to achieve the above objects in an invention of claim 1. In order to reflect a beam of light by a recording layer of recorded media and to detect the contents of record of recorded media, A light source which is a pickup containing a beam splitter and an electric eye, and emits said beam of light, An angle of plane of polarization of a beam of light emitted from said light source A pivotable plane-of-polarization pivot means, Drive mechanism which drives said plane-of-polarization pivot means, and an optical focusing means which makes recorded media condense a beam of light, It is arranged to a field between said optical focusing means and said plane-of-polarization pivot means, and an angle of plane of polarization of a beam of light comprises a polarizing plate provided with a filter part which responds to an angle of plane of polarization of a transparent part which can penetrate a beam of light, and a beam of light independently, and penetrates or shades a beam of light.
[0020]Said plane-of-polarization pivot means is constituted from an invention of claim 2 by doubly refracting crystal material.
[0021]Said plane-of-polarization pivot means comprises a charge of a plane-of-polarization rotary material from which angle of rotation of plane of polarization differs according to transmission distance of a beam of light.
[0022]
[Embodiment of the Invention]The pickup of a first embodiment by this invention is explained based on an accompanying drawing. The same numerals are given to the same member as the pickup explained in the column of conventional technology, and those explanation is omitted except for a required portion. The pickup of this invention shown in drawing 1 formed the different actuator moving part 15 from the composition of the conventional actuator moving part 6, and has formed the plane-of-polarization slewing mechanism 16 between the beam splitter 5 and the collimate lens 7 further.
[0023]The actuator moving part 15 comprises the object lens 9 and the polarizing plate 17, and the polarizing plate 17, As the outline composition is shown in drawing 3 (a), the polarizing filter part 17A which can penetrate only the optical beam of a certain fixed polarization angle of rotation, and the polarization angle of rotation comprise the transparent part 17B which could penetrate the optical beam independently and was provided near the center of said polarizing filter part 17A. At this time, the polarizing filter part 17A is an optical beam (to the irradiation light of the high density optical disk 1a) with a wavelength of 650 nm, as shown in drawing 3 (b). [and] And the optical beam of S polarization is made to penetrate 100%, while it can respond also to the standard optical disk 1b, and it has the character which shades the optical beam of P polarization 100%.
[0024]For example, the film etc. in which the dielectric multilayer was made to form using Sio_2, TiO_2, etc. as the polarizing filter part 17A which has such the characteristic are used. It is more desirable to have covered the transparent part 17B and to perform a mask at the time of production of the polarizing plate 17 which forms such a polarizing filter part 17A, so that multilayer films, such as Sio_2 or TiO_2, may not be attached to the transparent part 17B. As long as the penetration characteristic shown in

drawing 3 (b) is obtained, the polarizing filter part 17A may not be limited to above-mentioned composition, and may be formed using other methods and materials.

[0025]What fulfills the following conditions is chosen and used for the numerical aperture of the object lens 9. Namely, at the time of high density optical disk 1a playback (refer to drawing 1). After the optical beam of S polarization which penetrates the polarizing filter part 17A and the transparent part 17B of the polarizing plate 17 penetrates an object lens, Condense the best for the recording layer of the high density optical disk 1a, and at the time of standard optical disk 1b playback (refer to drawing 2). When penetrating the polarizing plate 17, after the optical beam of P polarization which is shaded by the polarizing filter part 17A and penetrates only the transparent part 17B penetrates the object lens 9, it is the object lens 9 of a numerical aperture which condenses the best for the recording layer of the standard optical disk 1b.

[0026]And the above-mentioned plane-of-polarization slewing mechanism 16 comprises the 1/2 phase difference plate 18 and the slewing mechanism 19 which fixes it enabling free rotation, as shown in drawing 4. In this specification, a phase difference plate is the plate in which say the plate polished in the thickness of the request of doubly refracting crystal materials (for example, crystal or mica etc.) in order to obtain a desired double reflex, and the 1/2 phase difference plate 18 shown especially in drawing 4 and drawing 5 grinds doubly refracting crystal material, and it was made for a double reflex to be 180 degrees.

[0027]As shown in drawing 1 and drawing 2, it is connected to the drive mechanism 20 which consists of stepping motors, and the 1/2 phase difference plate 18 rotates the slewing mechanism 19 which fixes the 1/2 phase difference plate 18 enabling free rotation by driving the drive mechanism 20. At this time, as shown in drawing 4 and drawing 5, seen from the direction of movement of the dashed dotted line L which shows the direction of movement of light, the 1/2 phase difference plate 18 rotates clockwise, and uses angle of rotation of this 1/2 phase difference plate 18 as the angle of rotation theta. The slewing mechanism 19 can rotate the 1/2 phase difference plate 18 so that the angle of rotation theta may be 0 degree or 90 degrees with the drive mechanism 20. As shown in drawing 5, Po will show the plane of polarization of the beam of light (namely, beam of light emitted from the laser light source 8) which advances into the 1/2 phase difference plate 18, and the angle of rotation of plane-of-polarization Po penetration before of the 1/2 phase difference plate 18 and after a penetration will be shown by delta (refer to drawing 5 (b)).

[0028]Drawing 6 is a chart showing the relation between the angle of rotation theta of the 1/2 phase difference plate 18, and the angle of rotation delta of plane-of-polarization Po. If the angle of rotation theta of the 1/2 phase difference plate 18 which both the angles of rotation theta and delta have in proportionality, and is shown in drawing 5 (a) shall be 0 degree so that clearly from this chart, The angle of rotation theta of the 1/2 phase difference plate 18 shown in drawing 5 (b) is 90 degrees, therefore the planes of polarization P are a penetration front of the 1/2 phase difference plate 18, and after a penetration, and are rotating it 90 degrees.

[0029]Then, playback of the high density optical disk 1a and the standard optical disk 1b is explained using the pickup of this invention. The case where the high density optical disk 1a first shown in drawing 1 is played is explained. The optical beam emitted from the laser light source 8 is beforehand set as a 635-650-nm wavelength band region, and this emitted light is set up further advance by the optical beam of S polarization to the plane-of-polarization slewing mechanism 16. When the kind of

optical disc will be detected by a detector (graphic display abbreviation) if the high density optical disk 1a is fixed to the prescribed position of a pickup, and it is detected that it is the high density optical disk 1a, the drive mechanism 20 does not operate but, for this reason, the angle of rotation theta of the 1/2 phase difference plate 18 is 0 degree.

[0030]Although the optical beam emitted from the laser light source 8 advances into the collimate lens 7, and is changed into a parallel pencil of rays and the plane-of-polarization slewing mechanism 16 is penetrated, Since the angle of rotation theta of the 1/2 phase difference plate 18 is 0 degree, as mentioned above an optical beam, As shown in drawing 5 (a), it goes on to the beam splitter 5, without plane-of-polarization Po rotating by penetrating the 1/2 phase difference plate 18, and it dichotomizes to the transmitted light and catoptric light with the half mirror of beam splitter 5 inside. The optical beam reflected among this optical beam advances above drawing 1, and advances to the polarizing plate 17 in the actuator moving part 15. On the other hand, the penetrated optical beam is not related to a reproduction operation at all.

[0031]Since the polarizing filter part 17A of the polarizing plate 17 is the characteristic shown in above-mentioned drawing 3 (b) and it penetrates the optical beam of S polarization 100%, all the optical beams which advance to the polarizing plate 17 penetrate the polarizing plate 17, advance to the object lens 9, and condense it the best for the recording layer of the high density optical disk 1a. The optical beam reflected by the recording layer of the high density optical disk 1a, Penetrate the object lens 9 and the polarizing plate 17, and it goes on to the beam splitter 5, It dichotomizes to the transmitted light and catoptric light again, and the optical beam which penetrates the beam splitter 5 penetrates the condenser 4 and the cylindrical lens 3, it goes on to the electric eye 2, and the high density optical disk 1a is played by detecting the optical beam. On the other hand, the optical beam reflected by the beam splitter 5 is not related to a reproduction operation at all.

[0032]The case where the standard optical disk 1b shown in drawing 2 is played is explained. If the standard optical disk 1b is fixed to the prescribed position of a pickup, If the kind of optical disc is detected by a detector (graphic display abbreviation) and it is detected that it is the standard optical disk 1b, the drive mechanism 20 will drive the slewing mechanism 19, and the 1/2 phase difference plate 18 will be rotated so that the angle of rotation theta may be 90 degrees.

[0033]And the optical beam emitted from the laser light source 8 advances into the collimate lens 7, is changed into a parallel pencil of rays, and penetrates the plane-of-polarization slewing mechanism 16. Since 90 degrees of 1/2 phase difference plates 18 which are the members forming of the plane-of-polarization slewing mechanism 16 are rotating at this time, the angle of rotation delta of plane-of-polarization Po. It is a penetration front of the 1/2 phase difference plate 18, and after a penetration, and since 90 degrees rotates, while penetrating the plane-of-polarization slewing mechanism 16, 90 degrees of optical beams set up have an angle of rotation of S polarization to the plane-of-polarization slewing mechanism 16 beforehand rotate, and turn into an optical beam of P polarization.

[0034]Furthermore, an optical beam advances into the polarizing plate 17 via the beam splitter 5. Since the polarizing filter part 17A shades the optical beam of P polarization 100%, only the optical beam which advanced to the transparent part 17B among the optical beams which advanced into the polarizing plate 17 advances to the object lens 9. Thus, since the width of the optical beam which penetrated only the transparent part 17B of the polarizing plate 17 differs from it in the case of the above-mentioned high density optical disk 1a, the condensing position after penetrating the object lens 9 is different. For this reason, the standard optical disk 1b in which distance differs from the position of the recording layer

of the high density optical disk 1a can also be made to condense an optical beam the optimal (henceforth the aperture restriction effect). At this time, it cannot be overemphasized that the polarizing plate 17 is formed so that the condensing position of the optical beam which penetrated only the transparent part 17B and penetrated the object lens 9 further, and the recording layer of the standard optical disk 1b may correspond. Since it is the same as that of what was explained with the high density optical disk 1a, subsequent reproduction motion is omitted.

[0035]Here, although it had composition with the stepping motor, the drive mechanism 20 which rotates the 1/2 phase difference plate 18 is not limited to this, a DC motor with an encoder, etc. may be used, for example, and other methods may be used for it as long as they are 0 degree thru/or a thing which rotates 90 degrees about the 1/2 phase difference plate 18.

[0036]As another example of the plane-of-polarization slewing mechanism 16, as shown in drawing 7 and drawing 8, it is good also as composition provided with the soleil phase plate 21. . In the soleil phase plate 21, are used as members forming of the polarimeter which measures the optical rotation of a substance. it is the so-called quartz wedge correcting plate of soleil -- the inclined plane of the almost wedge-shaped left-handed-quartz object 21A and the right-handed-quartz object 21B -- respectively -- prescribed distance **** -- it being arranged and constituted so that it may counter, and, A plane of polarization (namely, plane of polarization) can be rotated by carrying out slide movement of the right-handed-quartz object 21B, and changing the transmission distance of an optical beam (refer to drawing 10).

[0037]As the soleil phase plate 21 is connected to the drive mechanism 20 (refer to drawing 1) provided with a stepping motor in order to make the transmission distance of an optical beam change, and shown in drawing 7 and drawing 8, The left-handed-quartz object 21A is being fixed to the position which always crosses the optic axis L of an optical beam, and on the other hand, in a figure, the right-handed-quartz object 21B is mostly moved to a sliding direction so that the inclined plane of the left-handed-quartz object 21A may be met. Since each is a wedge shape mostly, the lenses 21A and 21B differ with movement of the right-handed-quartz object 21B in thickness [of soleil phase plate 21 the very thing] d, i.e., the transmission distance of an optical beam.

[0038]For this reason, since plane-of-polarization Po of an optical beam carries out predetermined angle rotation with movement of the right-handed-quartz object 21B, it sets up carry out prescribed distance movement of the right-handed-quartz object 21B beforehand so that the angle of rotation of plane-of-polarization Po may be set to thickness d of the request which will be 90 degrees. In not driving the drive mechanism 20 as shown in drawing 9 (a) if it sets up in this way, As plane-of-polarization Po of an optical beam does not rotate while penetrating the soleil phase plate 21, but shown in drawing 9 (b), Since 90 degrees of plane-of-polarization Po of an optical beam will rotate by penetrating the soleil phase plate 21 if the drive mechanism 20 is driven and the right-handed-quartz object 21B is moved, it functions as the plane-of-polarization slewing mechanism 16 provided with the 1/2 phase plate 18 explained based on drawing 5 identically. Therefore, also when the plane-of-polarization slewing mechanism 16 provided with the soleil phase plate 21 is used, since the regeneration method of the optical discs 1a and 1b is the same, the explanation is omitted.

[0039]Instead of forming the polarizing plate 17, in order to attain much more weight saving of the actuator moving part 15, as shown in drawing 11, for example, -- forming a multilayer film in a part of 1

surface of the object lens 9 using SiO_2, TiO_2, etc., and considering it as polarizing filter part 17A' -- the polarizing filter part 17A -- 'the object lens 9 provided with the function of the polarizing plate 17 by making except into transparent part 17B" may be formed. Also in this case, the numerical aperture of object lens 9' is set up like the object lens 9 explained based on above-mentioned drawing 1 and drawing 2.

[0040]The drive mechanism 20 to which the right-handed-quartz object 21B of the soleil phase plate 21 is moved may not be limited to a stepping motor, and a DC motor with an encoder, an actuator, etc. may be used for it, for example.

[0041]In actually using the pickup of this invention, As for the polarizing plate 17 and the object lens 9, since the aperture restriction effect will not fully be acquired, but it will become easy to produce an error and it will lead to the characteristic degradation of a pickup if the gap with the center of the optic axis of an optical beam and the position of the object lens 9 becomes large, approaching is desirable.

[0042]

[Effect of the Invention]Since this invention is the structure of the pickup constituted as explained above, in the invention of claim 1. It determines whether drive plane-of-polarization slewing mechanism according to the kind of optical disc which it is going to play, Angle of rotation of the plane of polarization of an optical beam is changed, the aperture restriction effect can be acquired and the condensing positions of an object lens are made to differ by penetrating the polarizing plate further provided with the polarizing filter part shaded or penetrated according to the angle of this plane of polarization. For this reason, since an optical beam can make it condense the best for each recording layer even if it is an optical disc of a different kind, it becomes renewable [two or more kinds of optical discs] by one set of a pickup. Since the condensing position of an optical beam is made to change by driving plane-of-polarization slewing mechanism, it becomes possible to keep the characteristic of an actuator moving part good, and since a gap of an optic axis can be controlled, generating of an error can be prevented.

[0043]Since plane-of-polarization slewing mechanism is constituted from the invention of claim 2 by doubly refracting crystal material and the plane of polarization of an optical beam can be rotated according to the kind of optical disc by carrying out predetermined angle rotation of this doubly refracting crystal material, the composition of plane-of-polarization slewing mechanism is simplified, and it is low cost. In addition, it has the same effect as the invention according to claim 1.

[0044]In the invention of claim 3, since the plane-of-polarization slewing mechanism can rotate plane of polarization by comprising a soleil phase plate (charge of a plane-of-polarization rotary material), moving a right-handed-quartz object according to the kind of optical disc, and changing the transmission distance of an optical beam, the composition of plane-of-polarization slewing mechanism is simplified, and it is low cost. In addition, it has the same effect as the invention according to claim 1.

[Translation done.]